88064971

TN
859
.U82
W4171
1985

BLM Library
D-553A, Building 50
Denver Federal Center
P. O. Box 25047
Denver, CO 80225-0047

1985 ENVIRONMENTAL PROGRAMS

WHITE RIVER SHALE PROJECT

White River Shale Oil Corporation

July 2, 1984

TABLE OF CONTENTS

		Page
1.0	Introduction	1
2.0	Summary of the 1985 Environmental Programs	6
	2.1 The 1985 Environmental Monitoring Summary	7
	2.2 The 1985 Monitoring Analysis Program Summary	11
	2.3 The 1985 Revegetation Evaluation Summary	12
3.0	The 1985 Environmental Monitoring Program	13
	3.1 Introduction	13
	3.2 The 1985 Water Resources Monitoring Program	14
	3.3 The 1985 Vegetation Monitoring Program	31
	3.4 The 1985 Air Monitoring Program	36
	3.5 The 1985 Aquatic Biology Monitoring Program	41
	3.6 The 1985 Terrestrial Fauna Monitoring Program	46
4.0	The 1985 Monitoring Analysis Program	49
5.0	The 1985 Revegetation Evaluation Program	53
	5.1 Program Description	53
6.0	References	

LIST OF FIGURES

		Page
1	Inter-relationships of Parameters with Project Activities or Potential Impacts	3

LIST OF TABLES

2.1-1	1985 Water Resources Monitoring Program	8
3.2-1	1985 Water Resources Monitoring Program	16
3.2-2	Water Quality Parameters for Laboratory Analysis	18
3.2-3	1984 Surface Water Monitoring Stations and Modifications for the 1985 Program	19
3.2-4	1984 Ground Water Wells and Modifications	21
3.2-5	1984 Hydrometeorology Monitoring Stations and Modifications	23
3.3-1	1985 Vegetation Monitoring Program	33
3.4-1	Air Resources Program for 1985	38
3.5-1	Aquatic Biology Monitoring program for 1985	44
3.6-1	1985 Terrestrial Fauna Monitoring Program	48
5-1	Revegetation Evaluation Program Modifications for 1985	54

1.0 INTRODUCTION

The 1985 Environmental Programs for the White River Shale Project (WRSP) will consist of three areas of work. These are: Environmental Monitoring; Monitoring Analysis; and, Revegetation Evaluation.

In the development of the WRSP environmental monitoring program conducted over the past ten years, parameters for monitoring have been selected based upon the experience of the investigators conducting the program. This has led to the selection of parameters which biologically encompass the dominant groups of organisms occurring on and adjacent to the tracts. Physically, in air quality and water resources, parameters were selected to meet regulatory requirements and to permit measurement of those chemical and physical pollutants known to be dominant in oil shale development and processing.

Environmental characterization and monitoring has proceeded without interruption since the initiation of the baseline program in 1974. In 1982, the program was given new direction by the publication and implementation of the Environmental Monitoring Manual (EMM). The overall program goal stated in the EMM is to detect impacts of oil shale development and determine the cause of those impacts so that corrective measures may be taken if necessary. The EMM added new parameters and/or new monitoring sites to the monitoring program. These new parameters were intended to fill data gaps so that quantitative relationships could be generated which would aid in detecting impacts and identifying pathways. This resulted in an expanded program during 1981-1984.

As stated in the EMM, the WRSP Environmental Monitoring Program is a dynamic effort. As our knowledge of the environment grows, our understanding of the effects of development increases. Likewise, as the requirements of various environmental laws, regulations, permit conditions or lease stipulations change, so will the emphasis and design of the monitoring program. It is the intent of the White River Shale Oil Corporation (WRSOC) to maintain a flexible program which addresses current needs.

WRSOC has collected continuous environmental data on tracts Ua and Ub for ten years. This data collection includes air and water quality, terrestrial and aquatic biology as well as reclamation research. At the time of publication of the EMM it was agreed with the Oil Shale Project Office (OSPO) that the environment had been characterized and that the monitoring program should enter into a monitoring mode.

In addition, an in-house program review conducted during 1983, as well as efforts in Ecosystem Analysis summarized in the 1983 Environmental Progress Report, concluded that the physical and biological components of the tract ecosystem have been adequately characterized by the data collection since 1974.

WRSOC realizes that as development schedules are altered and/or different aspects of development take place, different potential impact causing activities occur. In the EMM these activities were delineated in a perturbation-response matrix of activities versus ecosystem attributes potentially affected. Figure 1 (i.e., Figure 1.0-1 from the EMM) presents those activities expected to create impacts and the parameters expected to be impacted. During construction phases, activities expected to generate impacts include surface disturbance, noise, human activity, air pollutant emissions and fugitive dust. Once retorting and oil shale disposal begin, additional sources of impact including plant site runoff and leachate from spent shale will be superimposed upon these construction

Figure 1

INTER-RELATIONSHIPS OF PARAMETERS WITH PROJECT ACTIVITIES OR POTENTIAL IMPACTS

CHAPTER NUMBER	2			3									4							5											6			
	AIR QUALITY	VISIBILITY	METEOROLOGICAL FACTORS	ANNUAL PLANT BIOMASS	PERENNIAL PLANT PRODUCTS	LICHEN PRODUCTION	LITTER FALL	PLANT CHEMICAL COMPOSITION	PLANT CONDITION	PLANT UTILIZATION	SOIL PHYS. - CHEM. FACTORS	SOIL MICROBIOLOGY	PERIPHYTON BIOMASS	INVERTEBRATE BIOMASS	DRIFT	PERIPHYTON PRODUCTION	INVERTEBRATE PRODUCTION	DECOMPOSITION RATE	PHYSICAL FACTORS	RESIDENT BIRDS (1)	MIGRATORY BIRDS	SMALL MAMMALS	MEDIUM MAMMALS	REPTILES	FOLIAGE INVERTEBRATES	SOIL INVERTEBRATES	WATERFOWL	RAPTORS	THREAT. & ENDG. SPECIES	LARGE MAMMALS	SURFACE WATER QUALITY	GROUNDWATER QUALITY	FLOW (SURFACE-GROUNDWATER)	SURFACE WATER SEDIMENT LOAD
URFACE DISTURBANCE	●	●	●	●	●	●	◆			◆	●	●	◆	◆	◆	◆	◆	◆	◆	●	●	●	●	●	●	●	◆	●	◆		●	●	●	●
OISE/ACTIVITY	●	●				●				◆	◆	◆								●	●	◆	◆	◆			●	●	◆	●			◆	◆
ASEOUS AIR EMISSIONS	●	●	●	●	●	●	●	●	●	◆	●	●	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	●	◆	◆	◆	◆		◆			
UST	●	●	●	●	●	●	●	●	●	◆	●	●	◆	◆	◆	◆	◆	◆	◆	◆	◆	●	●	●	●	●	◆	◆	◆		●			●
LANT SITE RUN OFF											◆	◆	●	●	●	●	●	●	●	◆	◆						◆	◆	●		●	●	●	●
EACHATE				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	◆	◆	●	●	●	◆	●	●	●	●	●	●	●		
ITIGATION RECLAMATION	●	◆	◆	●	●	◆	◆	◆	●	●	●	●	◆	◆	◆	◆	◆	●	●	◆	◆	●	●	◆	●	◆	●	●	◆	●	●	●	●	●

1 PRODUCTION AND DISTRIBUTION OF POPULATION

● DIRECT IMPACT ——► PROJECT ACTIVITY MAY CAUSE AN IMMEDIATE RESPONSE IN THE MEASURED PARAMETER.

◆ INDIRECT IMPACT ——► PROJECT ACTIVITY WHICH, THROUGH AN IMMEDIATE RESPONSE IN ONE PARAMETER MAY CAUSE A DELAYED OR SECONDARY RESPONSE IN A RELATED PARAMETER.

During the 1982 and 1983 construction period, the only observed impacts occurring on tract were those resulting from the surface disturbance associated with construction activities. Basically, the impacts involved the removal of soil and vegetation from construction disturbed areas. In addition, groundwater level fluculations from local blasting were noted, but no overall increase or decrease in groundwater storage was evident. No other impacts were measured. Most disciplines, particularly biology considered this period a no impact period with data collected being merely a continuation of the baseline. Where applicable, reclamation of disturbed areas was instituted and these reclaimed areas have subsequently been monitored for revegetation success.

WRSOC is anticipating a minimum level of activities during 1985 and for some additional period of time following 1985. During this time no major construction activities will take place and essentially only maintenance level activities will occur on tracts. Based upon the experience gained during the 1982-1983 construction period, this level of activity precludes the possibility of any impacts occurring during this time.

WRSOC has developed an environmental monitoring program for 1985 which is based upon the philosophy of the EMM and encompasses the considerations discussed above. Specifically, the scope of the program was derived using the following logic:

1. The existing environment of tracts Ua and Ub has been fully characterized by the monitoring done to date.

2. There will be no new impacts during 1985 since there will be no new construction during 1985.

3. Therefore, the 1985 monitoring program should consider only those parameters which could be affected by past development (i.e., runoff retention dam) or those required by permit and/or other regulatory stipulations (i.e., revegetation success).

Section 3.0 of this document describes the 1985 Environmental Monitoring Program for the WRSP.

WRSOC feels that this time of minimum activity provides a good opportunity to review the goals and objectives of the monitoring program as a whole and to investigate pathways and further refine the WRSP program for impact detection. This type of effort is consistent with the goals and philosophy of the EMM. Consequently, WRSOC intends to initiate a Monitoring Analysis Program in 1985. Section 4.0 of this document discusses the projected future efforts in this area.

In addition to the field monitoring and monitoring analysis programs, WRSOC plans to continue with reclamation studies intended to provide the type of information needed to meet anticipated reclamation requirements in future years. Section 5.0 of this document describes the 1985 efforts in this area.

2.0 SUMMARY OF THE 1985 ENVIRONMENTAL PROGRAMS

During 1985, WRSOC will implement three separate Environmental Monitoring Programs: The 1985 Environmental Monitoring Program; The 1985 Monitoring Analysis Program, and; The 1985 Revegetation Evaluation Program. Each of these programs are discussed in detail in sections 3.0, 4.0 and 5.0 of this document.

The following summarize the major efforts associated with each of these programs.

2.1 1985 Environmental Monitoring Summary

2.1.1 Water Resources Monitoring Program

The 1985 Water Resources Monitoring Program is geared toward the detection of impacts associated with past construction activities and meeting permit/ regulatory requirements. Table 2.1-1 summarizes the 1985 program.

2.1.2 Vegetation Monitoring Program

The 1985 Vegetation Monitoring Program will consist of monitoring those areas which have been disturbed and subsequently revegetated. The goal of the program is to determine the success or failure of WRSOC's revegetation efforts to date. Monitoring will also include sampling of adjacent undisturbed vegetation to serve as reference areas to document success.

2.1.3 Air Monitoring Program

Beginning in 1985, all of WRSOC's air resources measurements will be discontinued. This change from the 1984 program is consistent with the premise that with no construction or other work occurring on the tracts during 1985, there will be no air quality impacts.

Table 2.1-1

WHITE RIVER SHALE PROJECT
1985 WATER RESOURCES
MONITORING PROGRAM

Surface Water

Station Number	Station Location	Parameters Monitored(a)	Frequency of Collection
09306602	Plant Site Wash below Retention Dam	Q	Continuous
		SS	Opportunistic
		EC	Continuous
		FWQ	Opportunistic
		LWQ	Opportunistic
RES-1	Plant Site Reservoir	Stage	Continuous
		FWQ	Quarterly
		LWQ	Quarterly

Hydrometeorology

Station Designation	Type of Gauge	Monitoring Period	Remarks
Precipitation			
ARS-1	Recording(b)	Year round	New Station near Plant Site Retentio Dam
Evaporation			
EVP-1	Pan	April through October	New Pan near Plant Site Retention Dam.

(a) Q = Discharge
SS = Suspended Sediment
EC = Specific Conductance
FWQ = Field Water Quality Measurements (T, EC, pH, DO)
LWQ = Water Quality Samples for Laboratory Analyses

(b) Wind run, maximum and minimum temperature, and relative humidity are also monitored at this site.

Table 2.1-1 (cont'd)

Ground Water

Area	Well Number	Geologic Unit Monitored[c]	Frequency of Collection: Water Level	Frequency of Collection: Water Quality
Southam Canyon	P-2 lower	Birds Nest Zone	Quarterly	Annually
Plant Site Wash[d]	G-5	Birds Nest Zone	Continuous	Annually
	G-11	Birds Nest Zone	Continuous	Annually
	AG-10	Alluvium	Monthly	Quarterly
	UF-1-1	Uinta Fm. (LGZ)	Monthly	Quarterly
	UF-1-2	Uinta Fm. (IZ)	Monthly	Quarterly
	UF-1-3	Uinta Fm. (NSPZ)	As needed[e]	As needed[e]
	UF-1-4	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-2-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-2-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-2-3	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-3-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-3-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-4-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-4-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-4-3	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-5-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly
	UF-5-2	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-6-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly
	UF-6-2	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
Evacuation Creek	P-3	Birds Nest Zone	Quarterly	Annual
	G-10	Birds Nest Zone	Quarterly	Annual

(c) UNDIF = Undifferentiated Uinta Beds
GMU = Gray Marlstone Unit
NSPZ = Near Surface Porous Zone
IZ = Intermediate Zone
LGZ = Lower Gradational Zone

(d) The plant site retention dam monitoring wells (UF-wells and AG-10) were recently drilled. When water is first encountered at each of these wells, an initial water quality sample will be collected. Thereafter, samples would be collected on a quarterly basis with field measurements of pH, temperature and specific conductance on a monthly basis.

(e) As needed indicates that these wells are voluntarily monitored by WRSOC. These wells are exempt from SMP monitoring requirements.

2.1.4 Aquatics Biology Monitoring Program

During 1985, all aquatic biology monitoring for impacts to the White River will be discontinued. Again, this change from the 1984 program is consistent with the premise that with no construction or other activities occurring on the tracts during 1985, there will be no impacts to the biology of the White River.

2.1.5 Terrestrial Fauna Monitoring Program

In light of the cessation of construction/mining activities during 1985, there will be no impacts to the terrestrial ecosystem on tracts. Hence, only monitoring to meet regulatory requirements or to track past impacts will be required, and will consist of Raptor monitoring only.

2.2 The 1985 Monitoring Analysis Program Summary

Because of the low level of field activity in 1985, WRSOC feels that this presents an opportunity to evaluate monitoring goals and objectives, and to develop detailed plans for the future refining of the entire monitoring program. This is the objective of the 1985 Monitoring Analysis Program. The plans developed as a result of this effort would lay the ground-work for a refined monitoring approach which would better focus the program technically as well as in regard to development-specific schedules.

2.3 The 1985 Revegetation Evaluation Summary

During 1985, the Revegetation Evaluation Program will consist of three ongoing studies: the topsoil storage pile studies; the habitat enhancement work on section 6; and, the salt accumulation study on the oil shale disposal site at Anvil Points. Each of these studies will provide needed information for the development of future revegetation/reclamation efforts which WRSOC will eventually be required to implement.

3.0 THE 1985 ENVIRONMENTAL MONITORING PROGRAM

3.1 Introduction

The following sections describe the 1985 Environmental Monitoring Program for the White River Shale Project (WRSP). Each of WRSOC's environmental consultant's prepared a 1985 scope of work and rationale for their respective disciplines assuming no new construction activities during this period. As discussed in Section 1.0, each consultant feels that the baseline for their respective discipline has been characterized by the large amount of data collected over the last 10 years.

As discussed in the EMM, the goal of the WRSP monitoring program is to detect project related impacts on the environment. Since there will be no new impacts during 1985, each of the monitoring programs described in the following sections has been designed to either detect impacts from past construction activities or to satisfy permit and/or other regulatory requirements.

Many of the parameters which were monitored during the 1982-1984 construction period are not appropriate for a no construction, no impact period. Consequently, the overall scope of the 1985 monitoring program has been reduced. A program rationale is provided with the description of the 1985 monitoring program for each discipline.

WRSOC will re-initiate monitoring of discontinued parameters one full year prior to the start-up of new construction or operational activities unless the focusing of the monitoring program results in elimination of the need to monitor certain parameters.

3.2 The 1985 Water Resources Monitoring Program

As discussed in the EMM, the Water Resources Monitoring Program was designed to determine potential project-related impacts on the hydrologic environment. The basic approach of this program was to be:

- o flexible and responsive to observed charges.
- o in compliance with federal, state and local regulations.
- o able to identify and provide timely notice of project-related impacts.

The 1985 Water Resources Monitoring Program is in agreement with the above requirements and illustrates the flexibility of the EMM to allow for changes in the monitoring program according to project activity levels.

Collection of water resources data for the WRSP has occurred since 1974 and the natural or baseline conditions existing at Tracts Ua and Ub have been adequately characterized from the data collected to date. During initial project construction activities in 1982 and 1983, minimal or no project-related impacts to the hydrologic environment have been detected (outside of temporary ground water level fluctuations possibly due to blasting activities).

Since there will be no new construction activities occurring during 1985, no new or unexpected impacts can be anticipated. Thus, the 1985 Water Resources Monitoring Program will be reduced or refined, where necessary, to detect impacts associated with prior construction activities in Plant Site Wash (i.e., the mine shaft, decline, and retention dam) and to meet applicable regulatory and permit requirements.

The 1985 Water Resources Program will be focused upon meeting these requirements by monitoring for potential impacts resulting from:

- o subsurface leakage from the Plant Site Wash Retention Dam, including a complete water balance study of the pond.

- o water level and water quality changes in the Bird's Nest Zone due to construction of the mine shaft and decline.

- o unanticipated escape of impounded water from the the Plant Site Wash Retention Dam due to flood or other events over which the operator has no control.

The entire 1985 monitoring program is summarized in Tables 3.2-1 and 3.2-2. Table 3.2-3 compares the 1984 Surface Water Monitoring Program with the 1985 program, while Table 3.2-4 compares the 1984 Ground Water Monitoring Program with the 1985 program. Table 3.2-5 compares the 1984 Hydrometeorology Monitoring Program with the 1985 program. The following pages provide the details associated with the 1985 program.

3.2.1 1985 Monitoring Program for Surface Water

3.2.1.1 Evacuation Creek

Monitoring on Evacuation Creek (Station 09306430) will be discontinued dur-

Table 3.2-1

WHITE RIVER SHALE PROJECT
1985 WATER RESOURCES
MONITORING PROGRAM

Surface Water

Station Number	Station Location	Parameters Monitored(a)	Frequency of Collection
09306602	Plant Site Wash below Retention Dam	Q	Continuous
		SS	Opportunistic
		EC	Continuous
		FWQ	Opportunistic
		LWQ	Opportunistic
RES-1	Plant Site Reservoir	Stage	Continuous
		FWQ	Quarterly
		LWQ	Quarterly

Hydrometeorology

Station Designation	Type of Gauge	Monitoring Period	Remarks
Precipitation ARS-1	Recording(b)	Year round	New Station near Plant Site Retention Dam
Evaporation EVP-1	Pan	April through October	New Pan near Plant Site Retention Dam.

(a) Q = Discharge
SS = Suspended Sediment
EC = Specific Conductance
FWQ = Field Water Quality Measurements (T, EC, pH, DO)
LWQ = Water Quality Samples for Laboratory Analyses

(b) Wind run, maximum and minimum temperature, and relative humidity are also monitored at this site.

Table 3.2-1 (cont'd)

Ground Water

Area	Well Number	Geologic Unit Monitored[c]	Frequency of Collection: Water Level	Frequency of Collection: Water Quality
Southam Canyon	P-2 lower	Birds Nest Zone	Quarterly	Annually
Plant Site Wash[d]	G-5	Birds Nest Zone	Continuous	Annually
	G-11	Birds Nest Zone	Continuous	Annually
	AG-10	Alluvium	Monthly	Quarterly
	UF-1-1	Uinta Fm. (LGZ)	Monthly	Quarterly
	UF-1-2	Uinta Fm. (IZ)	Monthly	Quarterly
	UF-1-3	Uinta Fm. (NSPZ)	As needed[e]	As needed[e]
	UF-1-4	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-2-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-2-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-2-3	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-3-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-3-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-4-1	Uinta Fm. (NSPZ)	Monthly	Quarterly
	UF-4-2	Uinta Fm. (GMU)	Monthly	Quarterly
	UF-4-3	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-5-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly
	UF-5-2	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
	UF-6-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly
	UF-6-2	Uinta Fm. (UNDIF)	As needed[e]	As needed[e]
Evacuation Creek	P-3	Birds Nest Zone	Quarterly	Annual
	G-10	Birds Nest Zone	Quarterly	Annual

(c) UNDIF = Undifferentiated Uinta Beds IZ = Intermediate Zone
GMU = Gray Marlstone Unit LGZ = Lower Gradational Zone
NSPZ = Near Surface Porous Zone

(d) The plant site retention dam monitoring wells (UF-wells and AG-10) were recently drilled. When water is first encountered at each of these wells, an initial water quality sample will be collected. Thereafter, samples would be collected on a quarterly basis with field measurements of pH, temperature and specific conductance on a monthly basis.

(e) As needed indicates that these wells are voluntarily monitored by WRSOC. These wells are exempt from BLM monitoring requirements.

Table 3.2-2

WATER QUALITY PARAMETERS FOR LABORATORY ANALYSIS

Quarterly Parameters:[a]	Additional Semi-Annual and Annual Parameters:
Alkalinity, total, laboratory (as $CaCO_3$)	Aluminum, dissolved
Boron, dissolved	Arsenic, dissolved
Calcium, dissolved	Barium, dissolved
Carbon, organic, dissolved	Beryllium, dissolved
Chloride, dissolved	Cadmium, dissolved
Fluoride, dissolved	Chromium, dissolved
Hardness (as $CaCO_3$)	Color
Hardness, noncarbonate (as $CaCO_3$)	Copper, dissolved
Magnesium, dissolved	Cyanide, total recoverable
Nitrogen, ammonia, dissolved (as N)	Gross alpha, dissolved (as U-nat)[b]
Nitrogen, ammonia plus organic, total (as N)	Gross beta, dissolved (as Cs-137)
Nitrogen, nitrite, dissolved (as N)	Gross beta, dissolved (as Sr-90/Y-90)
Nitrogen, nitrite plus nitrate, dissolved (as N)	Iron, dissolved
pH, laboratory	Lead, dissolved
Phosphorus, orthophosphate, dissolved (as P)	Manganese, dissolved
Phosphorus, total (as P)	Mercury, dissolved
Potassium, dissolved	Molybdenum, dissolved
Residue, dissolved, calculated sum	Nickel, dissolved
Residue, on evaporation at 180°C, dissolved	Oil and grease, total recoverable
Residue, on evaporation at 105°C, suspended	Oxygen demand, chemical
Silica, dissolved (as SiO_2)	Phenols, total recoverable
Sodium adsorption ratio	Selenium, dissolved
Sodium, dissolved	Silver, dissolved
Sodium percent	Strontium, dissolved
Specific conductance, laboratory	Sulfide, total recoverable (as S)
Sulfate, dissolved	Turbidity
	Vanadium, dissolved
	Zinc, dissolved

(a) Quarterly laboratory analyses require alternating short and long list of parameters, as specified in Environmental Monitoring Manual (WRSOC, 1982), as currently revised.

(b) If gross alpha activity exceeds 15 pCi/l (or approximately 22 ug/l), then additional analyses will be done for dissolved Uranium and dissolved Radium-226.

Table 3.2-3

WHITE RIVER SHALE PROJECT
1984 SURFACE WATER MONITORING STATIONS
AND MODIFICATIONS FOR THE 1985
MONITORING PROGRAM

Station Number	Station Location	Current Parameters Monitored	Frequency of Collection	Modification
09306430	Evacuation Creek near Watson, Utah (near mouth of creek)	Q	Continuous	Discontinue
		FWQ	Weekly/bi-weekly	Discontinue
		LWQ	Once per year during snowmelt runoff	Discontinue
09306500	White River near Watson, Utah	Q	Quarterly	Discontinue
		SS	Quarterly	Discontinue
09306510	White River below Wagon Hound Canyon	EC	Continuous	Discontinue
		T	Continuous	Discontinue
		FWQ	Weekly/bi-weekly	Discontinue
		LWQ	Quarterly	Discontinue
09306602	Plant Site Wash	Q	Continuous	No Change
		SS	Opportunistic	No Change
		EC	Continuous	No Change
		FWQ	Opportunistic	No Change
		LWQ	Opportunistic	No Change
09306605	Southam Canyon Wash near Watson, Utah	Q	Partial Record (peaks only)	Discontinue
		SS	Opportunistic	Discontinue
		FWQ	Opportunistic	Discontinue
		LWQ	Opportunistic	Discontinue
09306610	Southam Canyon Wash at mouth, near Watson, Utah	Q	Continuous	Discontinue
		SS	Opportunistic	Discontinue
		EC	Continuous	Discontinue
		FWQ	Opportunistic	Discontinue
		LWQ	Opportunistic	Discontinue
09306615	White River above Asphalt Wash	FWQ	Weekly/bi-weekly	Discontinue
		LWQ	Quarterly	Discontinue
09306625	Asphalt Wash near mouth, near Watson Utah	Q	Continuous	Discontinue

Table 3.2-3 (cont'd)

Station Number	Station Location	Parameters Monitored	Frequency of Collection	Modification
09306700	White River below Asphalt Wash, near Watson, Utah	Q	Continuous	Discontinue
		SS	Quarterly	Discontinue
		EC	Continuous	Discontinue
		T	Continuous	Discontinue
RES-1	Plant Site Reservoir	Stage	Weekly	Change to Continuous
		FWQ	Quarterly	No Change
		LWQ	Quarterly	No Change

Notes: Q = Discharge (gauge height)
SS = Suspended sediment
EC = Specific conductance
T = Temperature
FWQ = Field water quality measurements (T, EC, pH, DO)
LWQ = Water quality samples for laboratory analyses

Table 3.2-4

WHITE RIVER SHALE PROJECT
1984 GROUND WATER WELLS AND MODIFICATIONS
FOR THE 1985 MONITORING PROGRAM

Area	Well Number	Geologic Unit Monitored[a]	Frequency of Collection[b] Water Level	Water Quality	Modification
Southam Canyon	G-2A	Alluvium	Quarterly	Contingency	Discontinue
	G-4A	Alluvium	Quarterly	Contingency	Discontinue
	AG-6-1	Alluvium	Quarterly	Contingency	Discontinue
	AG-7	Alluvium	Quarterly	Contingency	Discontinue
	P-2 upper	Uinta Fm. (LGZ)	Continuous	Annually	Discontinue
	P-2 lower	Birds Nest Zone	Continuous	Annually	Change Water Level to Quarterly
	G-15	Birds Nest Zone	Quarterly	Contingency	Discontinue
	G-21	Birds Nest Zone	Quarterly	Contingency	Discontinue
Plant Site	G-5	Birds Nest Zone	Quarterly	Annually	Change Water Level to Continuous
Wash	G-11	Birds Nest Zone	Quarterly	Annually	Change Water Level to Continuous
	AG-10	Alluvium	Monthly	Quarterly	No Change
	UF-1-1	Uinta Fm. (LGZ)	Monthly	Quarterly	No Change
	UF-1-2	Uinta Fm. (IZ)	Monthly	Quarterly	No Change
	UF-1-3	Uinta Fm. (NSPZ)	As needed	As needed	No Change
	UF-1-4	Uinta Fm. (GMU)	Monthly	Quarterly	No Change
	UF-2-1	Uinta Fm. (NSPZ)	Monthly	Quarterly	No Change
	UF-2-2	Uinta Fm. (GMU)	Monthly	Quarterly	No Change
	UF-2-3	Uinta Fm. (UNDIF)	As needed	As needed	No Change
	UF-3-1	Uinta Fm. (NSPZ)	Monthly	Quarterly	No Change
	UF-3-2	Uinta Fm. (GMU)	Monthly	Quarterly	No Change
	UF-4-1	Uinta Fm. (NSPZ)	Monthly	Quarterly	No Change
	UF-4-2	Uinta Fm. (GMU)	Monthly	Quarterly	No Change
	UF-4-3	Uinta Fm. (UNDIF)	As needed	As needed	No Change
	UF-5-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly	No Change
	UF-5-2	Uinta Fm. (UNDIF)	As needed	As needed	No Change
	UF-6-1	Uinta Fm. (NSPZ & GMU)	Monthly	Quarterly	No Change
	UF-6-2	Uinta Fm. (UNDIF)	As needed	As needed	No Change
Evacuation Creek	P-1	Birds Nest Zone	Continuous	Contingency	Discontinue
	P-3	Birds Nest Zone	Continuous	Contingency	Change Water Level to Quarterly, Change Water Quality to Annual
	G-8A	Birds Nest Zone	Quarterly	Contingency	Discontinue
	G-10	Birds Nest Zone	Quarterly	Contingency	No Change to Water Level, Change Water Quality to Annual
	G-14	Birds Nest Zone	Quarterly	Contingency	Discontinue

Table 3.2-4 (cont'd)

(a) UNDIF = Undifferentiated Uinta Beds IZ = Intermediate Zone
GMU = Gray Marlstone Unit LGZ = Lower Gradational Zone
NSPZ = Near Surface Porous Zone

(b) The plant site retention dam monitoring wells (UF-wells and AG-10) were recently drilled. When water is first encountered at each of these wells, an initial water quality sample will be collected. Thereafter, samples would be collected on a quarterly basis with field measurements of pH, temperature and specific conductance on a monthly basis. As needed indicates that these wells are voluntarily monitored by WRSOC. These wells are exempt from BLM monitoring requirements.

Table 3.2-5

1984 HYDROMETEOROLOGY MONITORING
STATIONS AND MODIFICATIONS
FOR THE 1985 MONITORING PROGRAM

Station Designation	Type of Gauge	Monitoring Period	Modification
Precipitation			
ARA-13	Recording	Year round	Discontinue
ARA-2	Recording	April through October	Discontinue
ARS-9	Recording	April through October	Discontinue
ARS-1	Recording	Year round	New gauge at Plant Site Retention Dam
RA-4	Storage	Year round	Discontinue
RB-1	Storage	Year round	Discontinue
RS-10	Storage	Year round	Discontinue
RS-11	Storage	Year round	Discontinue
RS-13	Storage	Year round	Discontinue
RV-7	Storage	Year round	Discontinue
RV-8	Storage	Year round	Discontinue
Evaporation			
EVP-9	Pan	April through October	Discontinue
EVP-13	Pan	April through October	Discontinue
EVP-1	Pan[a]	April through October	A new evaporation pan to be monitored at Plant Site Retention Dam.

(a) Wind run, maximum and minimum temperature, and relative humidity are also monitored at this site.

ing 1985. No project-related activities have occurred to date in the Evacuation Creek drainage. Therefore, there is no reason to continue to monitor for impacts on surface waters. (A minimum level ground water monitoring program will be maintained in Evacuation Creek, See Table 3.2-4.)

3.2.1.2 White River

Monitoring at the White River Stations 09306500, 09306510, 09306615 and 09306700 will be discontinued during 1985 since it is anticipated that there will be no significant project-related surface water discharges reaching the White River during this time. USGS water resources data collection will probably continue at White River Stations 09306395 and 09306900, above and below the tracts, respectively. These data will be utilized to determine background changes in the White River as needed.

3.2.1.3 Plant Site Wash

No changes will occur at Plant Site Wash Station 09306602. In addition, a program for continuous water level monitoring at the runoff retention pond will be initiated.

Monitoring at Station 09306602 will continue to document the quantity and quality of any water that escapes from the runoff retention dam.

The addition of continuous water-level monitoring on the retention pond will be used in a water-balance study for determining the volume of water in storage in the pond versus evaporative losses and possible percolation into materials

underlying the pond (also see Section 3.2.3.3). The continuous monitoring of water-level (stage) will become critical if a considerable volume of water is stored in the retention pond. Water quality sampling on a quarterly basis (alternating short and long parameter lists) will be implemented until this water is fully characterized. The decision to reduce the sampling frequency of the parameter list will be made in consultation with the OSPO.

3.2.1.4 Southam Canyon Wash

All monitoring at Southam Canyon Stations 09306610 and 09306605 will be discontinued during 1985 since no project activities have occurred to date in Southam Canyon and no new activities are planned for the area during 1985.

3.2.1.5 Asphalt Wash

Monitoring of Asphalt Wash Station 09306625 will be discontinued during 1985 since the Asphalt Wash drainage has not been disturbed by project-related activities to date and will not be disturbed by any activities during 1985.

3.2.2 1985 Monitoring Program for Ground Water

3.2.2.1 Bird's Nest Zone Wells

Wells P-1, G-8A, G-14, G-15 and G-21 will be deleted from the monitoring program. Well P-1 is currently monitored continuously while the other four wells are monitored for water levels quarterly. All five wells are currently sampled annually for water quality.

The discontinuance of these five wells will eliminate the collection of superfluous data in areas least likely to be affected by current project-related impacts. The five wells remaining in the program (P-2 Lower, P-3, G-5, G-10 and G-11) will provide adequate area coverage of the Bird's Nest Zone to detect and interpret water level and water quality impacts occurring near the mine shaft and decline.

Water quality sampling at wells G-10 and P-3 will be increased from a contingency to an annual basis. The parameters analyzed will remain unchanged (i.e., the long list). Wells G-10 and P-3 will be used in conjunction with well P-2 Lower (currently sampled annually) as control stations for water quality impact assessment purposes in the Bird's Nest Zone. These three wells, sampled annually, will provide background water quality data to compare with additional annual analyses from wells G-5 and G-11 located near the mine site. (Wells G-10, P-2 Lower, and P-3 will also provide background control for water levels in the BNZ.)

Wells P-2 Lower and P-3 will be reduced from continuous to quarterly monitoring schedules. Adequate long-term baseline water level data has been collected to characterize typical water level fluctuations at these wells. While short-term water level fluctuations may not be detected, it is believed past events of this type are predominantly natural effects and not substantially related to project activities. Therefore, quarterly water level measurements at these wells, when used in combination with continuous data from Wells G-5 and G-11, will be adequate during 1985 when project-related impacts are expected to be minimal.

A continuous monitoring schedule for water levels at wells G-5 and G-11 will be implemented during 1985. These wells are currently monitored continuously as a special temporary study to detect possible water level impacts occurring as a result of mine workings near these wells. Continuous recorders will be maintained at these wells through the 1984-85 water year, at the end of which time the need for continuous water levels will be re-evaluated in consultation with the OSPO. The mine workings are the only project component in direct contact with the Bird's Nest Zone and the possibility of aquifer dewatering or long-term effects of grouting at the mine should be monitored. Also, continuous water levels will provide a detailed data base for water levels near the mine, which has not yet been established. Continuous water levels will be extremely useful in interpreting possible future water quality impacts due to the mine, such as source and direction of possible unanticipated pollutant movement.

3.2.2.2 Uinta Formation Wells

Well P-2 Upper will be deleted from the monitoring program during 1985. Water levels at P-2 Upper have remained very stable throughout the period of record, and further measurement will not be necessary since baseline conditions are established and no impacts are expected during 1985.

3.2.2.3 Southam Canyon Alluvium

Wells G-2A, G-4A, AG-6-1 and AG-7 will be deleted from the monitoring program during 1985. Wells G-2A, G-4A and AG-7 have been shown not to contain any ground water during the entire period of record, indicating that very little or no ground water occurs in the upper reaches of Southam Canyon where the wells are located. This condition is likely to continue until substantial construction

modifications occur in the Canyon in preparation for test pads or commercial-scale disposal. Baseline groundwater conditions of AG-6-1 are sufficiently documented such that additional data are not required at this time.

3.2.2.4 Plant Site Wash Retention Dam Monitoring Wells

During 1985, there will be no reductions to the current monitoring program for these wells as described in Plant Site Wash Retention Dam Ground Water Monitoring Program (VTN, April 1984). Under sustained high water conditions at the Plant Site Wash Retention Pond, the program will also include measurement of porous-tip piezometers in the dam embankment and local springs or seeps.

The wells at the Plant Site Wash Retention Dam are being monitored in accordance with BLM requirements to determine possible leakage from the Dam.

There are five porous-tip piezometers installed by VTN in the dam embankment (Final Report on Earth Dam Instrumentation, Plant Site Wash Retention Dam, VTN, October 1983). These piezometers are not formally part of the ground water environmental monitoring program but are primarily for engineering and embankment stability purposes. Quarterly measurements will be made and recorded for the piezometer installations.

Table 3.2-4 compares the 1984 Ground Water Monitoring Program with the 1985 program.

3.2.3 1985 Monitoring Program for Hydrometeorology

3.2.3.1 Precipitation Gauges

Precipitation storage gauges RA-4, RB-1, RS-10, RS-11, RS-13, RV-7 and RV-8 will be discontinued. Precipitation recording gauges, ARA-13, ARA-2 and ARS-9 will also be discontinued. A new precipitation recording gauge (ARS-1) at the Plant Site Wash Retention Dam will be installed.

The average annual precipitation totals have been defined during the 1975-1983 studies and the temporal and spatial variation of precipitation across the tracts is well documented. During 1985, with limited, if any, field work being conducted, there will be no need for extensive quantification of tract wide precipitation or spatial and temporal patterns. However, precipitation data collection is needed at the Plant Site Wash Retention Dam. A new recording guage, ARS-1 will measure precipitation surrounding the project-disturbed areas and this information will be used in the water balance of the Plant Site Wash Retention Dam (water balance discussed in Section 3.2.1.3). This information will also be utilized in the Revegetation Program for determination of moisture profiles in the topsoil disposal piles.

3.2.3.2 Evaporation Pans

Evaporation pans EVP-9 and EVP-13 will be discontinued. A new evaporation pan (EVP-1) will be installed at the Plant Site Wash Retention Dam. The addition of a Class A evaporation pan at the Plant Site Wash Retention Dam is in support of the Water Balance as described in Section 3.2.1.3. Evaporation will not be monitored from other sites as no water retention facilities are planned at these locations.

3.2.3.3 Water Balance

A water balance analysis will be performed on the Plant Site Wash Retention Pond. The water balance will utilize: data collected at surface water station 09306602; data collected from the array of monitoring wells located below the retention dam; Plant Site Wash Retention Pond stage levels (RES-1); hydrometeorology data collected at the Evaporation Pan (EVP-1); precipitation data (ARS-1); and ancillary climatic data collected at the evaporation station.

If the Plant Site Wash monitoring wells indicate that runoff retention dam is leaking, the water balance study will provide a volumetric measurement of the leakage.

Table 3.2-5 compares the 1984 Hydrometeorology Program with the 1985 program.

3.3 The 1985 Vegetation Monitoring Program

As discussed in the EMM, the vegetation monitoring program was designed to provide data that describes the possible effects on the vegetation community caused by oil shale mining, processing and disposal of processed shale. The array of vegetation-related parameters used in monitoring includes key vegetation-related characteristics that are vital to ecosystem function. This stems from their sensitivity to immediate impacts of development or their response to cumulative influences plus interactions with affected ecosystem processes. The monitoring program includes variables that are indicative of environmental health and responsive to environmental impact.

The three main objectives of the vegetation monitoring program are:

- To document the existing vegetation conditions during and after various stages of development, including the range of variation exhibited temporally and geographically.

- To quantify plant responses to environmental impacts created by development, thereby allowing comparisons of plant responses in areas of little or no impact with those in areas of relatively high impact.

- To measure the success of revegetation techniques on the processed shale disposal pile and other areas that may be disturbed during operations.

Since there will be no new construction on site during 1985, it is appropriate to reduce the overall vegetation monitoring effort and to concentrate on documenting the impacts associated with the construction activities which

occurred during 1982-1984. Therefore, the 1985 Vegetation Monitoring Program will focus on the impacts that have occurred on tract by monitoring the mitigation measures that have been implemented in response to those impacts. The 1985 program will not reduce any monitoring effort that has been determined necessary to assess environmental change due to WRSOC activities or any effort that would hinder the goal of providing an effective restoration program that could be initiated when construction activities proceed. In addition, work will continue during 1985 in areas relating to reclamation. The 1985 reclamation evaluation activities are discussed in detail in Section 5.0 of this document.

Table 3.3-1 compares the 1985 Vegetation Monitoring Program with the 1984 program.

3.3.1 Monitoring of Vegetation Parameters

Over the past several years, many vegetation related parameters that might best be used to evaluate impacts have been selected and monitored to establish baseline information as required in the Oil Shale Lease Environmental Stipulations for Tracts Ua and Ub. These parameters now have documented bases and will not require further data until major development is initiated and impacts are anticipated. Several of the parameters that were initially categorized in the "potential" and "contingency" groups (plant condition and stress, plant chemical composition, and portions of the soil microbiology and chemistry) already have a sufficient base and data gathering has temporarily ceased.

Table 3.3-1

1985 Vegetation Monitoring Program
as compared with the 1984 Program

Monitoring Task No.	Type of Monitoring	Frequence of Sample	Modification
#1	Biomass production of annual vegetation	June	Discontinue
#2	Sagebrush leader growth	September	Discontinue
#3	Plant utilization	March October	Discontinue
#4	Special study on SO_2	Laboratory	Completed in 1984
#5	Litter fall	June	Take final samples to complete 3-yr. cycle
		October	Discontinue
#6	Soil microbiology	Jan. 15	Take final sample to complete 3-yr. cycle
	8 transects sampled for tests of:	April 15	Discontinue
	• microbial abundance	July 15	Discontinue
	• microbial activity	Oct. 15	Discontinue
	• soil chemistry		Discontinue
	• soil algae		Discontinue
#7	Lichen growth and occurrence as an air pollution index at 21 sites	August	Discontinue
#8	Monitor revegetation success:	June	No change
	• topsoil stockpiles	September	No change
	• disturbed area seedings		No change
	• adjacent undisturbed areas (for reference)		No change

Since there will be no construction related impacts on vegetation during 1985, essentially all of the vegetation monitoring tasks associated with the 1984 monitoring program will be discontinued. Two small exceptions are a final sampling of litterfall in June, 1985 and a January 15, 1985 sampling for soil microbiology characteristics. These samples are needed to complete the 3-year cycle on these two parameters.

3.3.2 Monitoring Reclamation Success

The greatest impact to date on the tracts has been the physical disruption associated with the initial construction activities occurring during 1982-1984. During this initial phase several roads were built, a retention dam was completed, the mine services building was completed, the ventilation shaft was finished, and the production decline and various other construction activities were completed. The topsoil from most of these disturbances was stripped and stockpiled where feasible. The areas that were disturbed but would remain removed from further activities were revegetated beginning in 1982 and continuing in 1983. Revegetation consisted of both seeding and planting of containerized plants.

The success of these activities was assessed in 1983 and will continue in 1984. The Utah Division of Oil, Gas and Mining requires that disturbed areas be evaluated for success (measured by cover, density or productivity) and areas that are unsuitable have corrective measures applied (Linner, personal communication). They also require identification of species that were successful, species that were unsuccessful, areas experiencing weed problems, and sites where unsuitable soil material may exist. This type of evaluation was initiated in 1984 and will continue as part of the 1985 vegetation monitoring program. This sampling will

also include sampling of the adjacent undisturbed vegetation to serve as reference areas to document success. Revegetation success monitoring will continue until a trend toward successful plant cover is established.

3.4 The 1985 Air Monitoring Program

The basic objectives of the WRSP air resources monitoring program as listed in the EMM, are as follows:

- To quantitatively determine the air quality impacts of various levels of oil shale development and operation on Tracts Ua and Ub.

- To demonstrate that impacts of the air contaminants emitted by the facilities are in compliance with the National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act, as well as with Utah air quality standards.

- To identify areas where additional control of air contaminant emissions would be appropriate or necessary.

- To continue observing the long-term evolution of regional air quality.

- To continue monitoring the meteorological environment to provide additional data for future modeling efforts as well as to monitor meteorological events (e.g., frontal passages) that might affect the regional air quality.

Satisfaction of the first three objectives entails two steps: (1) monitoring of baseline conditions; and (2) monitoring of the air quality when construction and operation are occurring.

Without an adequate knowledge of the baseline conditions, it would be impossible to determine the magnitude of any impacts. Baseline air monitoring was conducted on Tracts Ua and Ub from 1975 through 1981. Only the first two years were required under the Federal Prototype Oil Shale Leasing Program. Subsequent years (1977-1981) added to this required data base and helped to better establish the range of air quality values observed under natural conditions. Air quality measurements during 1982 through 1984 were continued to detect any impacts associated with site preparation and mine construction activities during those years. The seven baseline years and three minimal construction years have provided a more than adequate base against which to compare the impacts due to the WRSP and those due to other regional growth.

The EMM allows for changes in the monitoring program, tied to the level of activity on the tracts and the ability to meet the program objectives. The site-by-site changes to be implemented in 1985 are shown in Table 3.4-1. In summary, all continuous air measurements (except those associated with the water balance calculation as discussed in the water resources monitoring section) will be discontinued. This change is consistent with the premise that with no construction or other work on the tracts, there will be no air quality impacts.

Impacts from construction during the last three years were minimal. The atmosphere is generally quite "renewable" once localized pollution stops, and should return to background levels following the completion of current construction activities.

Monitoring will resume one year before further construction activity is planned, when impacts would again be possible, which is consistent with the program objectives.

Table 3.4-1

Air Resources Program for 1985
as compared to the 1984 Program

Station Number	Current Monitoring		Modification
	Parameter	Frequency	
A4	SO_2, NO_2, O_3, CO	Continuous	Discontinue
	TSP	Every 3 days	Discontinue
	WS, WD, T, σ_θ, σ_w	Continuous	Discontinue
A6	WS, WD, T, ΔT	Continuous	Discontinue
	RH, σ_θ, σ_w	Continuous	Discontinue
	SR, BP	Continuous	Discontinue
A10	TSP	Every 3 days	Discontinue
	WS, WD, T	Continuous	Discontinue
A11	WS, WD, T	Continuous	Discontinue
A13	WD, WD, T	Continuous	Discontinue

The last two objectives of the five listed earlier deal more with continued observation of the regional air quality and meteorology in this area. These objectives can still be met under the 1985 program. Monitoring initiated by Deseret Generation & Transmission Inc. (DG&T) for the Bonanza Power Plant in 1983 will continue to track several air parameters for the region. DG&T operates three sites in this area, one upwind of the power plant, one downwind (Raven Ridge), and one in Dinosaur National Monument. The upwind site is only about two miles from Tracts Ua and Ub, and should be representative of most incoming air for WRSP as well.

By the beginning of 1985, at least 12 months of simultaneous SO_2, NO_2 and TSP data should be available for both projects. These data will be compared to verify the representativeness of the DG&T data for the region. Subsequent DG&T data will be reviewed periodically to determine whether they show any changes in air quality that might warrant changes in the air resources program.

The last EMM program objective involves the collection of meteorological data for future modeling applications. The large base of continuous low-level winds and stability data that have been collected so far is more than adequate for most simplistic (steady-state, Gaussian) models. Continued monitoring of these types of parameters would not add to our knowledge of the atmospheric processes necessary for more sophisticated modeling.

In conclusion, the air monitoring program for 1985 has been eliminated for the following reasons:

- EMM program objectives are met.
- An air resources baseline has been collected.
- No new WRSP impacts will occur in 1985 and no residual impacts will carry over from the previous three construction years.
- Regional air quality and meteorology will still be monitored at a near-by site.
- No air resources monitoring is required at this stage by any existing air quality permits or regulations.

3.5 1985 Aquatic Biology Monitoring Program

The aquatic biology monitoring program for WRSP has been in place since 1981. The goals of this program as stated in the EMM are:

- To gather data which describes the aquatic ecosystem in sufficient detail to allow assessment of natural or project-related change.

- To organize data collection and analysis using a conceptual view of the ecosystem to determine the cause or pathway of these changes.

- To assess the effectiveness of mitigation and reclamation measures.

The EMM recognized that there would be project-related activities which would have the potential to cause direct or indirect changes to the aquatic ecosystem. These activities were depicted in Figure 1.0-1 of the EMM, which is included in Section 1.0 of this document as Figure 1. The components of the aquatic ecosystem in which impacts might occur are also shown.

Development of Tracts Ua and Ub would involve construction and operations. During construction, activities which cause physical disturbance will dominate. Associated with these activities will be increased erosion rates from earth-moving activities and dust, particulates and gaseous emissions from blasting and construction machinery. During the operation phases, oil shale retorting and disposal will occur. Associated with these activities will be the potential for leachates from processed shale and increased dust, particulates and gaseous emissions.

The EMM did not anticipate direct impacts to the aquatic ecosystem during construction and development (Figure 1). The most important potential for impact was expected to occur during retorting and shale disposal. In this phase, the introduction of low levels of leachates and altered patterns of organic input from the terrestrial system could affect rates of nutrient cycling and production of the decomposers and primary producers within the river system. These changes could manifest directly or indirectly in changes in the consumer populations, the invertebrates and fish.

Construction of roads, the mine and various plant site facilities has been occurring on the Tracts from 1982 through 1984. During this time aquatic biology data collection has proceeded in uninterrupted fashion except when high discharge levels or extreme icing conditions prevailed.

Aquatic biology monitoring during this period was focused at three sites. These were stream cross-sections in riffle habitats occurring both upstream and downstream of the area of influence of WRSP tract operations. The upstream location, WR03, was considered a control with the downstream locations WR18 and WR27 as treatments. WR27, below Asphalt Wash, was used as a second treatment site to look at changes further downstream in the event changes were documented at WR18. If changes due to tract operations occurred in the river, it was expected that statistical comparisons of monitoring parameters between these locations would reveal a significant difference.

A statistical analysis of the aquatic monitoring data collected during the 1981-1983 period indicates that no detectable impacts have occurred in the White River due to WRSOC construction activities. During 1985, WRSOC is not planning any further major on-site activities. This will substantially reduce the level

of activities occurring on-tract. Under this scenario, no project-related impacts to the White River are expected. Consequently, operational monitoring for impacts to the White River will be suspended during 1985 and will not be reinitiated until further construction or development activity proceeds.

Table 3.5-1 compares the 1984 Aquatics Biology Monitoring Program with the 1985 program.

Table 3.5-1

AQUATIC BIOLOGY MONITORING PROGRAM FOR 1985
AS COMPARED TO THE 1984 PROGRAM

Parameters	Current Schedule	Modification
Operational-Abiotic		
DO, NH_3, NO_2, NO_3, total nitrogen, total phosphorus, PO_4-P, total suspended solids, pH	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
light intensity, dominant substrate, water velocity, temperature, conductivity	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
Operational-Biotic		
periphyton -community biomass -density macroinvertebrates -species richness -community biomass -density	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
Potential-Abiotic		
interstitial sediments, discharge, stream cross section profiles	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
drift-organic input		
Potential-Biotic		
periphyton -production -respiration -P/R ratio macroinvertebrates -production -species biomass -diversity	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
decomposers/decomposition rate		

Table 3.5-1 (cont'd)

Parameters	Current Schedule	Modification
Contingency-Abiotic		
heavy metals, trace elements, micronutrients	Monthly at WR18 Quarterly at WR03, WR27	Discontinue
drift insect input		
Contingency-Biotic		
aquatic microbiology	Monthly at WR18	Discontinue
fish -distribution -relative densities	Quarterly at WR03, WR27	
periphyton -species richness -species biomass -diversity		
heavy metals in periphyton, macroinvertebrates and fish		

3.6 1985 Terrestrial Fauna Monitoring Program

The major objective of the terrestrial fauna monitoring program, as stated in the EMM, is to determine if mining and processing of oil shale and related activities significantly affect the structure and function of the local terrestrial ecosystem. Thus, there are three major goals:

- To determine if there is a departure from "normal", defined as ambient conditions during the baseline period.
- To discover if this departure is caused by man's activities or if it is related to natural environmental changes.
- To evaluate the success of reclamation efforts in terms of returning disturbed areas to their original conditions.

The terrestrial fauna monitoring is based on knowledge of what perturbations are expected from development of oil shale and how these perturbations might impact the terrestrial ecosystem. The expected perturbations are:

- surface disturbance - vegetation and soil removal
- noise
- activity
- gaseous air emissions
- dust generation
- leachate contamination of water
- runoff contamination of surface water

These perturbations will influence the terrestrial wildlife community as shown in Figure 1 in Section 1.0.

To date, no impacts to the terrestrial ecosystem have been detected as a result of the construction activities occurring between 1982-1984.

In light of the planned minimal activities at Ua-Ub during 1985, impact monitoring will no longer be required except to meet regulatory requirements and/or to document construction related impacts which may be long-lasting. Among the five Operational Parameters, one Potential Parameter, and six Contingency Parameters associated with the 1984 Terrestrial Fauna Monitoring Program, only one Operational Parameter needs to be retained during 1985: Raptor Monitoring.

Since 1982, raptor nests on Ua-Ub and in a two kilometer perimeter were mapped and activity and productivity monitored. These nests were used by golden eagles, red-tailed hawks, Cooper's hawks, prairie falcons, northern harriers, great horned owls, and long-eared owls.

The continued monitoring of nesting raptors, expecially golden eagles, is needed to determine: 1) golden eagle nesting patterns if it becomes necessary to mitigate taking a nest located near mining activity per the Eagle Protection Act and the more recent Permits to Take Golden Eagle Nests [FR48(251): 57295-57301; 29 Dec. 1983; Effective 30 Jan. 1984] and 2) to determine if golden eagles and other raptors avoid nests near the Plant Site during mining/construction activities. Table 3.6-1 presents WRSOC's 1985 Terrestrial Fauna Monitoring Program.

Table 3.6-1

1985 Terrestrial Fauna
Monitoring Program

OPERATIONAL PARAMETERS

	Feb.	Apr.	Jun.	Aug.	Oct.
1. Breeding Bird			-Discontinued-		
2. Raptors	-	5 Days	5 Days	-	-
3. Rodents			-Discontinued-		
4. Small to Large Mammals			-Discontinued-		
5. Threatened & Endangered Species			-Discontinued-		

POTENTIAL PARAMETERS

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
1. Foliage Invertebrates			-Discontinued-				

CONTINGENCY PARAMETERS

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
1. Chemical Uptake			-Discontinued-				
2. Spring Migratory Birds			-Discontinued-				
3. Reptiles			-Discontinued-				
4. Soil Invertebrates			-Discontinued-				
5. Waterfowl			-Discontinued-				
6. Bats			-Discontinued-				

4.0 1985 MONITORING ANALYSIS PROGRAM

WRSOC has concluded that all future monitoring efforts should be implemented in accordance with development activities and, as in the past, in consultation with OSPO. For example, WRSOC plans to implement a reduced monitoring program during 1985 because minimal development activities are expected to occur on tract and therefore no impacts are expected.

Because of the reduced level of field activities in 1985, WRSOC feels that this presents a good opportunity to review monitoring program goals and objectives, and to develop detailed plans for the future refining of the entire monitoring program. This is the objective of the 1985 Monitoring Analysis Program. The plan developed as a result of this effort would lay the groundwork for a refined monitoring approach which would better focus the program on impact detection and tie future monitoring to development-specific activities. This "focus" could be obtained, for example, through guiding future monitoring and data collection efforts by pathway analysis. This process would recognize that certain activities have the potential to create changes in specific ecosystem components before significantly altering others. Thus, knowledge about specific mechanisms of disruption which are related to development activities could allow the tailoring of monitoring parameters to these potential impacts and their symptoms, rather than attempt measuring everything in the ecosystem.

In 1982, WRSOC published the EMM. The overall program goal stated in the EMM is to detect impacts of oil shale development and determine the cause of those impacts so that corrective measures may be taken if necessary. The EMM delineated a unique philosophy and methodology of environmental monitoring for the effects of oil shale development.

This approach recognized that ecosystems are very complex and that it was not logistically practical or cost-effective to attempt quantitative characterization of all ecosystem components to the extent that change in any randomly selected component could be statistically documented. It also recognized that most baseline studies and environmental monitoring programs lack an organizing principle which allows the logical selection of monitoring parameters tailored to project development schedules and potential impact pathways. Without this organization, the attempt to monitor bogs down in the knowledge that enough data can never be collected. Consequently, WRSOC developed a monitoring program which attempts to intergrate standard baseline data collection with potential pathways and knowledge of cause and effect in ecosystem relationships.

A program review undertaken in 1983, and discussed in chapter 8 of the 1983 Environmental Progress Report, considered the overall environmental monitoring program and each of the five individual disciplines including Air Resources, Vegetation, Aquatic Biology, Terrestrial Fauna and Water Resources. The major objective of the review was to evaluate the environmental monitoring program efforts in view of overall program goals as stated in the EMM. The review was not exhaustive but qualitatively addressed the major goal of the monitoring program:

"The major goal of the program is to provide a body of information which describes the ecology of the project area in a manner which will:

1. Allow assessment of changes occurring in the physical and biological characteristics of the tracts as a result of the impact of surface

disturbances and pollutant discharges.

2. Guide analysis of cause and effect, thus leading to appropriate mitigation planning.

3. Guide and assess the effectiveness of mitigation and reclamation measures."

The program review recognized that WRSOC, in 8-9 years of data collection, has accumulated an extremely large data base which describes the dominant physical and biological features of the tract ecosystem. This information will serve as an excellent baseline for future comparisons. The program review recommended that the environmental monitoring program needs to change focus from the continuation of descriptive data collection to the selection of more refined monitoring parameters. These parameters should be more sensitive to pollutants and disturbances resulting from oil shale development and should be able to be measured with enough accuracy for detection of impacts outside of natural variability. This should allow a narrowing of program focus to critical areas with more tightly defined objectives which can, through proper sampling design, enhance the probability of detecting change. The steps involved in this process should be:

1. Identify specific pollutant groups and disturbances. Determine their source, pathways through the environment, their expected areas of impact, and potential symptoms.

2. Based upon these expected pathways and symptoms, identify parameters and relationships that might show the effects of pollutants and/or meet other program objectives.

3. Reevaluate and redefine both overall and single discipline objectives.

4. Refocus and streamline the monitoring program eliminating redundancy and using the best set of parameters and relationships that will detect impacts.

5. Design experiments (special studies), where needed, to look at the effect of pollutants on parameters or relationships.

The 1985 Monitoring Analysis Program will therefore attempt to develop the detailed plans necessary to design a more focused monitoring program. This set of detailed plans will provide a framework which will guide the direction and timing of the program refinement. For example, the detailed plans would specify what must actually be done to "reevaluate and redefine both overall and single discipline objectives" as well as when, in relation to the project development schedule, this should be completed.

5.0 THE 1985 REVEGETATION EVALUATION PROGRAM

5.1 Program Description

Work will continue during 1985 on revegetation projects that have been initiated in previous years. The 1985 Revegetation Evaluation Program will consist of three studies: the topsoil storage pile studies, the habitat enhancement work at section 6 and the salt accumulation study on the oil shale disposal pile at Anvil Points. The results of these studies will be important in determining reclamation criteria during developmental phases on site. Table 5-1 summarizes the 1985 work.

At this point, the reclamation strategy for disturbed sites is for the respreading of topsoil prior to revegetation. The topsoil will most likely be stored for some period of time prior to respreading. It is very important that the topsoil does not undergo a significant reduction in its fertility or biological activity. These characteristics have been shown to be valuable in vegetation establishment (Rives et al., 1980; Gould and Liberta, 1981; Redente and Cook, 1981). WRSOC has been evaluating the biological activity in topsoil storage piles and has established experiments on the tracts to aid in designing the most effective procedures for handling topsoil. The topics of prime research are the length of biological activity following stockpiling, the influence of stockpile depth on the biological activity and the influence of different species on retaining biological activity. These experiments are important and will continue so that the most advantageous stockpile design can be utilized when additional construction activities are implemented.

Table 5-1

Revegetation Evaluation Program
Modifications for 1985 as
compared with 1984 Program

Monitoring Task No.	Name of Study	Frequency of Sample	Modification
#1	Topsoil stockpile biological activity	June October	No change
#2	Root growth in shale	June	Next sample in 1987
#3	Soil analysis for pH and EC in shale/soil pile	June	No change
#4	Monitor plant establishment in seeding/interplanting	June	No change
#5	Monitor Anvil Points studies for growth and survival	June	No change

Topsoil stockpile studies have been or are currently being conducted at three locations: near the mine services building; at the end of the paved mine access road; and, at section 6. Each stockpile has unique characteristics that make it valuable in determining the most effective pile design and also the optimum storage length for topsoil piles. The most intensive work is being done at the stockpile near the mine services building where replicated plots have been established to evaluate the effects of depth, the influence of different vegetation types and the influence of fertilizers on the biological activity of the stockpile. The study at section 6 provides valuable data on long term viability of a pile since it is the oldest stockpile in the area; with data taken when it was initially established. The remaining stockpile is the largest and will be evaluated for cover and erosion protection as well as effects of a different seed mixture on biological activity.

Providing alternate sources of wildlife habitat and food for that displaced during development has been a concern of WRSOC and other major oil shale ventures. Research has been conducted in Colorado concerning techniques to increase forage production (particularly deer forage). A portion of that research has dealt with fertilization of undisturbed vegetation to increase productivity (Redente and Cook, 1982).

WRSOC has attemptd to evaluate the possibility of increasing productivity by interseeding and/or interplanting into adjacent undisturbed sites. This is based on the hypothesis that the full productivity of the site is not currently being utilized due to historical overgrazing and the invasion of weedy species. If desirable species were established, they could use moisture that is currently being utilized by less desirable species. This would increase the available forage and offset losses that would occur during development.

During 1985, the results of work initiated in 1981 and expanded in 1984 will be monitored at plots established at section 6. The monitoring will assess the biological and economic feasibility of improving plant community productivity on oil shale tracts Ua and Ub. The effects of fertilization, plant protection and species adaptability are the areas of major emphasis.

The third study, the measure of salt movement into the topsoil trench at Anvil Points will also continue in 1985. At this point in time, the most cost effective reclamation strategy for reclaiming the shale disposal piles is the use of trenches filled with topsoil, with sloping sides providing areas for water harvesting. This technique has gathered some criticism concerning long-term accumulation of salts in the root zone.

This may be a valid concern and must be addressed if the technique is to be suitable for large scale implementation. Other techniques for long term establishment of vegetation on processed oil shale are also under investigation at Anvil Points.

The study site at Anvil Points offers several years of data dealing with the revegetation of shale disposal piles. Due to its importance, WRSOC will continue to monitor this site. Emphasis will be on the movement of salts in the topsoil and processed shale, since the trench approach would offer the best utilization of the limited amounts of topsoil on the tracts and enhance the possibility of revegetation success. In addition, survival data will be collected for plants growing at the site using different treatments to the shale disposal pile. The survival data are important to demonstrate the long-term survival of species planted directly into processed shale, as well as other possible reclamation strategies.

6.0 REFERENCES

Gould, A.B. and A.E. Liberta. 1981. Effects of topsoil storage during surface mining on the viability of vesicular-arbuscular mycorrhiza. Mycologia 73: 914-922.

Linner, S. 1984. Personal communication. Reclamation Biologist, Utah Division of Oil, Gas and Mining.

Redente, E.F. and C.W. Cook. 1981. Revegetation studies on oil shale lands in the Piceance Basin. COO-4018-5.

Redente, E.F. and C.W. Cook. 1982. Revegetation studies on oil shale related disturbances in Colorado. DOE/EV/04018-6.

Rives, C.S., M.I. Bajwa, A.E. Liberta and R.M. Miller. 1980. Effects of topsoil storage during surface mining on the viability of VA mycorrhiza. Soil Science 129: 253-257.

VTN, 1983. Final Report on Earth Dam Instrumentation. Plant Site Wash Retention Dam. White River Shale Project. October, 1983.

VTN, 1984. Plant Site Wash Retention Dam Ground Water Monitoring Program. White River Shale Project. April, 1984.

WRSOC, 1982. Environmental Monitoring Manual. White River Shale Project. Prepared by White River Shale Oil Corporation, Salt Lake City, Utah. June, 1982.